

Kinetics and mechanism of iron monosulfide (FeS) oxidative dissolution

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Knowledge of the factors that affect the rates of iron monosulfide (FeS) oxidative dissolution is essential for characterizing the natural and industrial processes (acid mine drainage (AMD), metal extraction or treatment of mineral wastes).

This study takes into consideration the results obtained in our laboratory on FeS oxidative dissolution via the combination of aqueous batch experiments, potentiodynamic polarization measurements, cyclic voltammetry and spectroscopic analysis (Raman, Fourier Transform Infrared Spectroscopy (FTIR) and Electrochemical Impedance Spectroscopy (EIS)).

The obtained data indicate that reaction rate depends on the exposed surface, pH and temperature. In contrast, the rate of FeS oxidative dissolution is less influenced by the concentration of the oxidant (O_2 or Fe^{3+}). Minor influence of oxidant concentration on the reaction rate can be attributed to the formation of an inhibiting surface layer consisting of reaction products hardly crossed by the acceptors of electrons. The main reaction products of FeS oxidative dissolution were polysulfide (S_n^{2-}), elemental sulfur (S^0) and iron (Fe^{2+} and Fe^{3+}) oxyhydroxides.

It is important to note that the rates of FeS oxidative dissolution are influenced by the concentration of dissolved organic matter. Most probably the interaction between FeS and organic structures is mediated by iron atoms presents on mineral surface.

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